



Financial Feasibility and Constraints of *Betel vine* Cultivation in Coastal areas of *Sundarbans*, West Bengal

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The horticulture sector plays a significant role towards sustainable rural livelihoods in all farming systems including the marginal areas like coastal region of West Bengal. The region is characterized with multi-faceted problems such as low crop productivity due to inherent problem of soil & water salinity and hence low returns. Farmers are totally depended on nature and limited to mono-cropped by a single crop during wet (kharif/rainy) season. Cultivation of betel vine, one of the most important horticultural crops, is gradually gaining its popularity in this area as cash crop. Financial analyses through undiscounted cash flow measure, Payback Period and discounted cash flow measures like Benefit-Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were applied to understand the long term feasibility of investment on betel vine enterprise in the study area. The payback period was 2.81 years, IRR was estimated to be 45%, the NPV was Rs. 134614 and BCR was estimated to be 1.25 for the betel vine cultivation. All these criteria (IRR, NPV and BCR) were favourable for such investment on betel vine cultivation and the profitability was quite encouraging. Financial analysis indicated that investment on betel vine cultivation was not only profitable but highly attractive proposition and financially feasible for the region. This study indicates that inappropriate management of fertilizer and pesticides due to lack of adequate knowledge, often disease and insects attack, natural calamities, lack of water supply were the other most important constraints faced by the betel vine grower during production. Price fluctuation was the most important constraints faced by the betel vine cultivators to realise remunerative return to the investment on betel vine cultivation. Establishment of market intelligence system to forecast the price in a-priori and simultaneously exploring the export market (other states within the country or abroad) might be useful for realising better return on betel vine cultivation and second, young farmers are quite enthusiastic to cultivate the betel vine and promotion of this cash crop should be continued in other parts of the Sundarbans region for gainful employment.

(**Keywords :** *Betel vine, Coastal, Constraints, Financial feasibility*)

Betel vine in India is grown as an important cash crop across the states, of Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu, Assam, Bihar, Madhya Pradesh, Maharashtra, Orissa, Tripura, Uttar Pradesh and West Bengal. The Indian betel leaves (or '*Paan*') are in great demand in several countries like *Pakistan, Bangladesh, Indonesia, Malaysia, Burma and Thailand* where demand far exceeds the local supply. Consequently, leaves worth about Rs. 30-40 million are exported to European countries (Guha, 2006). It is an opportunity for the Indian betel vine growers as well as seller to earn more profit not only within the country but also to European countries. Further, as far as the national employment generation is concerned, about 20 million people derive their livelihoods directly or indirectly from production, processing, handling, transportation and marketing of betel leaves in India (Guha, 2006). It is one of the important commercial crops grown mostly by

small and marginal farmers across the country. On an average about 66% of such production is contributed by the state of West Bengal where it is cultivated on about 20,000 ha encompassing about 4-5 lakh '*baroj*' employing about the same number (4-5 lakh) of agricultural families (Guha, 2006). Betel vines are to be grown in closed conservatories, locally called '*baroj*' with a view to protect the vines from desiccation in summer and cold in winter. '*Baroj*' are generally rectangular in shape and its normal size is often 50 to 30 sq. meters. Generally *baroj* are small because its maintenance ought to be easy and their cost of erection is within manageable limits.

Cultivation of betel vine, one of the most important horticultural crops and gradually gaining its popularity in this area as cash crop. Betel vine cultivation in *Sundarbans* has its overall and holistic socio-economic impact on the farming community. The region otherwise

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is characterized with multi-faceted problems such as low crop productivity due to inherent problem of soil & water salinity and hence low returns. Farmers depend on natural sources completely and are able to cultivate only a single crop during the rainy season that is they are bound to mono-cropping (Mandal *et al.*, 2013). It is the most important cash crop and its cultivation has already brought a perceptible and conspicuous change in the livelihood security of farmers in *Sundarban* region and its farming population. Farmers are selling their produce at local markets as well as at distant markets like in Midnapore district or in other markets (Chandra and Sagar, 2004). However, the betel vine is susceptible to damage caused by insects, rain and wind. Shortage of irrigation can also cause hindrance for the growth of betel vine. High cost of fertilizer & pesticide, fluctuating price, many intermediaries, inadequacy of finance, transport, absence of grading, lack of storage facility also cause of great loss to farmers. Although profitable, but many farmers were switching over to other crops from betel vine due to lack of money/credit facilities and also high price uncertainty in the local market (Absar, 2015). 'Paan' chewing is slowly replaced by the 'gutkha' (an areca product made for chewing), which leads to decrease in demand for betel leaves. In view of the above problems in betel vine cultivation the current study focuses on answering the questions like, what are the economics of production? How far the betel vine cultivation in the study area is financially feasible in terms of long term investment? What are the constraints in production and marketing of betel vine in the study area?

MATERIALS AND METHODS

This study has been conducted in the coastal salt affected areas of West Bengal which comprises South 24 Parganas, North 24 Parganas, East Medinipur and Howrah districts. Out of these four districts, South 24 Pargana district has been selected purposively because it has maximum salt affected areas and betel vine was one of the most important cash crops for the farmers. Two blocks, Sagar and Kakdwip were selected purposively, because these blocks are leading in terms of area and production of betel vine in the district and also presence of wholesale market in Kakdwip town. Two villages from each block were selected randomly for the study. However, one village was added in case of Sagar Island to obtain adequate number of sample farms in the study area. Therefore, finally three villages (Kirtankhali, Kamalpur and Khansabad) were selected purposively from the Sagar block and two villages (Sipkainagar and

Srinagar) were elected from the Kakdwip block. The present study was based on primary data collected from 80 farm households (HH) in the study area. The primary data were collected from the sample farmers on pre-structured schedules through personal interview method for the agricultural year 2015-2016. Detailed information on betel vines such as starting year, initial investment, disposal of betel vine from the field, average selling price, cash inflow and outflows, packing and transportation, pricing and market information, problems related production and marketing, have been collected.

For investment analysis, undiscounted cash flow measure of project worth, namely, Payback Period and discounted cash flow measures of project worth, namely, Benefit-Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were applied. Financial feasibility analysis for betel vine cultivation was carried out with the assumptions of (1) 8 years of economic life (beyond this period there was a need of substantial investment on 'baro'j construction), (2) The benefits from the betel vine cultivation was stemming from the later part of first year itself, (3) discount rate @ 12 percent. This was the maximum interest rate charged by the lender (institutional) for agricultural activities in the study area and therefore was taken as proxy for discount rate and (4) the analysis followed assumption of constant prices i.e., assuming the price movement for inputs and outputs will be in same magnitude over the period of time.

Constraints were done through computing Garret rank for the constraints faced by farmers. List of various constraints was prepared after detail discussion with the farmers. Then farmers were asked to assign rank to these constraints during personal interview. Based on the rank assigned by farmers, constraints have been prioritized through computing Garret rank following standard procedure and with the help of Garret table. The order of merit assigned by the respondents was changed in to ranks by employing the formulas as,

$$\text{Percent position} = 100(R_{ij} - 0.50)/N_j,$$

Where R rank given i^{th} item by j^{th} individual and N = number of item ranked by j^{th} individual.

The position of each rank is converted into score by referring tables given by Garret and Woodworth (1969). Then for each factor, the score of individual respondents are added together and divided by the total number of respondents for whom scores are added. The mean scores for all the factors are ranked by arranging in descending order.

RESULTS AND DISCUSSION

Socio-economic status of the betel vine farmers

Average family size of the sample households was 5.69. Agriculture was the primary occupation of the majority of respondents (97%) while the rest (3%) earned their livelihoods from small business and daily labourers working on others field. Cultivation of betel vine was labour intensive and needed regular care and maintenance, therefore, primary occupation of the betel growers were agriculture. Average age of the respondents farmer was 42 years and out of which 50% of them were below 40 years, indicating the encouragement of growing betel vine among young farmers. As far as literacy was concerned, 100% respondents were literate, in which around 11%, 69% and 20% respondents were having the education level up to class IV, V to X and above X, respectively. Average operational holding size was 0.40 hectare (ha) and average experience in betel vine farming was 15 years. Around 95 % betel vine growers purchased vine (cuttings of the plants used as seed or propagation) during first year of planting from neighbour farmers and 5% grower planted their vine from own field (those who have multiple *baroj*). Average

family income of the sampled betel vine farmers was Rs. 72380 per year.

Area, soil characteristics and betel vine cultivars

Average area under betel vine cultivation (*baroj*) was calculated to be 0.05 ha on sample farmers (Table 2). All the farmers were growing betel vine on their own land and no leasing system was prevailing in the study area. The reason might be, growing betel vine requires change in land configuration and *baroj* construction with substantial investment and grown over 8-10 years on same land, labour intensive, high maintenance cost, needs day to day care and management and also subjected to risk due to price fluctuations. In betel vine cultivation availability of irrigation water was essential and therefore it was grown under 100% irrigated condition. Over 86 % respondent irrigate their land through pump set from own pond, while the rest of the respondents irrigate their land from neighbour's pond on payment basis. Soil type is mostly clay and soil was affected by salinity. The area is normally low lying and affected by waterlogging but betel vine was growing on raised land (100%) to avoid water logging. Among varieties grown, over 95 % growers preferred to grow

Table 1. Socio economic profile of the betel vine farmers in study area

Sl. No.	Particulars	Value
A	Family Particulars	
	(i) Family Size (no)	5.69
B	Occupation pattern	
	(i) Agriculture (%)	96.67
	(ii) Others (%)	3.33
C	Age of the respondent	
	(i) Average age (years)	41.53
	(ii) Age (up to 40 years) (%)	50
	(iii) Age (above 40 years) (%)	50
D	Education	
	(i) Literacy rate (%)	100
	(ii) Up to class IV (%)	10.83
	(iii) UP to class V – X (%)	69.17
	(iii) Above X (%)	20
E	Average operational holding size (ha)	0.40
F	Experience in betel vine farming (years)	15.18
G	Sourcing of betel vine planting materials	
	(i) Own source (%)	5
	(ii) Other (%)	95
H	Average family income (¹ /year)	72380

Table 2. Land particulars under betel vine cultivation in study area

Sl. No.	Particulars	Quantity (no/ value)
A	Area under betel vine cultivation (ha)	0.05
B	Land ownership (betel vine) ownership (%)	100
C	Irrigation availability (%)	100
D	Sources of irrigation	
	a) Own (%)	86
	b) Other (%)	14
E	Soil type	
	Clay (%)	100
F	Soil characteristic	
	Saline (%)	100
G	Land type under betel vine*	
	High land (%)	100
H	Variety cultivated	
	a) <i>Meetha</i> (%)	95.83
	b) <i>Bangla</i> (%)	4.17

Note: Highland means no waterlogging throughout the year

Meetha (sweet) variety because of the higher market price as compared to *Bangla* variety (5 %).

Initial cost of 'baroj' construction

Construction of *baroj* with thatches was essential for betel vine cultivation and required substantial amount of initial investment (Table 3). Soil excavation to make the raised land required around 100 numbers of labourers (man-days) for 0.05 ha of land. The cost for this labour was calculated to be Rs. 25000. Land preparation cost was the major cost component of *baroj* construction. Other cost components were bamboo, jute stick, bricks, straw, iron-wire, lime, ropes and seedlings (vine). Besides, water sprayer, knapsack sprayer were needed to manage the betel vine *baroj*. Also, fertilizer and pesticides were applied during land preparation in the initial year of field preparation. Total cost for *baroj* construction was calculated to be Rs. 121300 for an average area of 0.05 ha in the study area.

Annual costs and returns of betel vine cultivation

Cultivation of betel vine involves annual operational and maintenance cost over the economic life of the *baroj*. The cost components includes time to time land preparation/management, daily intercultural operation, maintenance/repairing of *baroj* by using jute stick, use of fertilizer, pesticides, irrigation, harvesting, packing, transportation and land revenue (Table 4). The production of betel leaves have been calculated to be around 29 *motes* (1 *mote* comprised of 10000 betel

leaves) from an average area of 0.05 ha in the study area per year. Average annual total cost of cultivation, gross return and net return have been calculated to be Rs.174561/- (including Rs. 7893/- as interest rate computed on working capital), and Rs. 68005/- respectively, for an average area of 0.05 ha of *baroj*. The costs return analysis indicated betel vine cultivation is quite profitable venture in the study area which is the primary reason for increasing the area under betel vine cultivation in recent years.

Financial feasibility of betel vine cultivation in the study area

Financial analyses to understand the long term feasibility of investment on betel vine enterprise in the study area has been calculated to find out whether the investment will yield a reasonable rate of return to all resources engaged for an average unit (here 0.05 ha) of cultivation (Table 5). For this, undiscounted cash flow measure, Payback Period and discounted cash flow measures like Benefit-Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were applied (Gittinger, 1984). IRR was estimated to be 45%, NPV was Rs. 134614 and BCR was 1.25 for the betel vine cultivation. All these criteria (IRR, NPV and BCR) were favourable for such investment on betel vine cultivation and the profitability was quite encouraging. The payback period had been calculated to be 2.81 years indicating the time required to recover the initial investment made in the cultivation. Financial analysis

Table 3. Cost of baroj* construction for betel vine cultivation in the study area (on average area of 0.05 ha)

Sl. No.	Particulars	Quantity	Value(Rs. /unit)	Total value (Rs.)
1	Pond excavation, raising land and field preparation	100 man days	250	25000
2	Small bamboo	280 numbers	30	8400
3	Large bamboo	50 numbers	150	7500
4	Jute stick	30 bundles	320	9600
5	Nylon net	1500ft.	9	13500
6	Bricks	200 numbers	11	2200
7	Straw	4 bundles	1600	6400
8	8 no iron wire	30 kg	50	1500
9	14 no iron wire	30kg	50	1500
10	Seedlings/vines	2000 numbers	12	24000
11	Water sprayer	1 number	150	150
12	Knapsack sprayer	1 number	300	300
13	Labour for <i>baroj</i> construction	30 numbers	250	7500
14	Labour for vine plantation	30 numbers	250	7500
15	Lime	100 kg	10	1000
16	Rope (kg)	15 kg	150	2250
17	Fertilizer and pesticide			1000
18	Miscellaneous			2000
Total				121300

Note: *Baroj is a close conservatory made to protect delicate betel vine from sun or cold

Table 4. Annual costs and returns for betel vine cultivation in the study area (on average area of 0.05 ha)

Sl. No.	Particulars	Quantity/value
A	a Land preparation (Rs.)	11350
	b Inter culturing operations (Rs.)	9338
	c Jute stick (Rs.)	7398
	d Fertilizer (Rs.)	32242
	e Pesticide (Rs.)	5449
	f Irrigation (Rs.)	2419
	g Annual repair cost (Rs.)	9300
	h Harvesting (Rs.)	5609
	I Packing (Rs.)	10870
	j Transportation (Rs.)	4661
	k Land revenue (Rs.)	27
	Total cost (Rs.)	98663
B	Interest rate on working capital (8% per annum)	7893
C	Return (Rs.)	174561
D	Betel vine production (no. of <i>motes</i>)	29.09
E	Net return (Rs.)	68005

Note: Average selling of betel leaves was Rs. 6000 per *motes*. 1 *motes* equals 10000 no of leaves

Table 5. Financial feasibility of betel vines cultivation under study area

Sl. No.	Particulars	Economic life in years							
		1st	2nd	3rd	4th	5th	6th	7th	8th
A	Fixed cost								
	Construction of <i>baroj</i> (Rs.)	56402	0	0	0	0	0	0	0
	Cost of vine (Rs.)	17848	0	0	0	0	0	0	0
	Land revenue (Rs.)	25	25	25	25	25	25	25	25
	Subtotal (Rs.)	74275	25	25	25	25	25	25	25
B	Variable cost								
	Land preparation (Rs.)	39553	18009	8958	13419	13220	11969	9404	10221
	Inter cultural operation (Rs.)	6514	11525	9799	8726	10851	9390	7270	12990
	Jute stick (Rs.)	16198	5777	6174	9464	11066	10886	5550	10432
	Fertilizer (Rs.)	29964	32888	31684	33180	38906	34173	33186	28028
	Pesticide (Rs.)	5332	4390	4641	6208	6527	5966	5260	4071
	Irrigation (Rs.)	3750	3200	3380	3600	2967	3400	3340	3450
	Annual repairing cost (Rs.)	0	10948	8260	8852	18275	4196	12758	8614
	Harvesting (Rs.)	3354	10002	3383	7217	8421	6536	3824	8156
	Packaging (Rs.)	10131	14947	11924	11550	12929	10572	9826	16874
	Transportation (Rs.)	6674	8401	4542	4449	6238	2900	4600	6222
	Subtotal (Rs.)	121470	120087	92745	106665	129400	99988	95018	109058
	Total cost (Rs.)	195745	120112	92770	106690	129425	100013	95043	109083
C	Return (Rs.)	53450	180681	166391	186893	210200	173160	156234	149117
D	Terminal value/discarded jute sticks and straw (Rs.)	0	439	488	599	619	521	431	3 7 5
E	Net return (Rs.)	-142295	61008	74109	80802	81394	73668	61622	40434

Note: Above mentioned costs are applicable areas under 0.05 ha. IRR = 45%, NPV = Rs. 134614, BCR = 1.25 and Payback period = 2.81

indicated that investment on betel vine cultivation was not only profitable but highly attractive proposition and financially feasible for the region. The average return based on annual costs and return (Rs.174561 in Table 4) was based on the average of annual costs and return incurred by the farmers over the entire economic life (8 years) of the betel vine cultivation. However, this costs and returns would be varying across the different years in the economic life the betel vine plantations. Under this *ex-ante* financial analysis, all the betel vine '*baroj*' were classified into different age groups, say '*baroj*' in first year, '*baroj*' in second year and so on. The input and output relationship for any plantation crop varies across the age of the plantations and normally production follows a gradual peak, decline and finally becomes no more financially viable. After this classification the costs and returns were calculated at different age of the plantation. It was assumed (called simulation) that a '*baroj*' currently in a given year (say second year) will be in a same condition after 3 years similar to a '*baroj*' at 5th year of age. Because of this nature of the cyclical production

pattern, the costs and return flows in the financial analysis was slightly different from the annual costs and returns.

Constraints faced by the betel vine grower during production

Constraints analysis in production and marketing of betel vine cultivation by farmers was analyzed through computing Garrett ranking of various constraints. Details discussion was held with the farmers and list of important constraints was prepared. Individually, farmers were asked these constraints to assign the rank based on the severity of a particular constraint. Based on this rank, finally Garrett rank has been computed to prioritize the constraints faced by the farmers. In the result Table 6 & 7 both rank i.e. rank based on percentage as well as that computed following Garrett's ranking. The constraint analysis indicates that inappropriate management of fertilizer and pesticides due to lack of adequate knowledge is the most important constraints faced by the betel vine cultivators to enhance their production (Table 6). Often disease and insects attack, affected the

Table 6. Constraints perceived by the traditional farmers in production

Sl. No.	Problems	Total Score	Mean Score	Rank
1	Inappropriate management of fertilizer and pesticides	5207	59.17	1
2	Disease and insects attack	5187	58.94	2
3	Natural calamities	5136	58.36	3
4	Lack of water supply	4209	47.83	4
5	Soil salinity	3954	44.93	5
6	Need of daily maintenance	3711	42.17	6
7	Lack of labour Supply	3396	38.59	7

Table 7. Constraints perceived by the betel vine farmers in marketing

Sl. No.	Problems	Total Score	Mean Score	Rank
1	Price fluctuation	6493	73.78	1
2	Unauthorized deductions	5475	62.21	2
3	Non availability of storage facilities	4927	55.981	3
4	Highly perishable commodity	4109	46.69	4
5	Lack of market information	3433	39.01	5
6	High commission charged	3195	36.30	6
7	High transport cost	3168	36	7

growth, natural calamities, lack of water supply were the other most important constraints faced by the traditional farmers during production. The betel vine farms were severely affected by wilt disease. Both the quality and quantity of betel vine gets affected. Natural calamities were another important factor which severely affects the 'baroj'. Other important constraints encountered by the farmers are soil salinity, need of daily maintenance and lack of timely labour supply.

Constraints faced by the betel vine grower during marketing

The constraint analysis indicates that price fluctuation was the most important constraints faced by the traditional betel vine cultivators in the study area (Table 7). The second rank had given to, unauthorized deductions by the traders and 'arhatdars' (commission agents). Non-availability of storage facilities had given the third rank. High perishability had considered as a fourth ranked constraint. Other important constraints encountered by the farmers are lack of market information, high commission charged, high transport cost.

CONCLUSIONS

The study showed that the betel vine cultivation was profitable in the study area and the profitability was quite encouraging. Financial analysis indicated that investment on betel vine cultivation was not only profitable but highly attractive proposition. This study

indicates that inappropriate management of fertilizer and pesticides due to lack of adequate knowledge is the most important constraints faced by the betel vine cultivators to enhance their production. Often disease and insects attack, affected the plant growth, natural calamities, lack of water supply were the other most important constraints faced by the betel vine grower during production. Price fluctuation was the most important constraints faced by the betel vine cultivators to realise remunerative return to the investment on betel vine cultivation. Unauthorized deductions by the traders, middleman and 'aratdars' (commission agents), non-availability of storage facilities were another important problems faced by the famers. Based on the study following recommendations are made for enhancing the profitability of betel vine cultivation in the study area, *first*, farmers should have easy access to information in related to production management and marketing. Establishment of market information system to forecast the price in a-priori and simultaneously exploring the export market (other states within the country or abroad) might be useful for realising better return to betel vine cultivation. *Secondly*, young farmers are quite enthusiastic to cultivate the betel vine and promotion of this cash crop should be continued in other parts of the Sundarbans region for gainful employment and retaining rural youth in agriculture.

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